

Amendments to the Claims

Listing of Claims

Claims 1-35 (canceled)

36. (currently amended) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

an electrically insulating polymer base material configured for deposition onto the substrate or the component as a non-flowing viscous material; and

a plurality of solder particles in the base material comprising an eutectic solder configured to melt and to rigidify the connections.

37. (currently amended) The underfill material of claim 36 wherein the particles comprise ~~a-eutectic~~ a PbSn solder.

38. (original) The underfill material of claim 36 wherein the particles have a diameter of from 1 μm to 10 μm .

39. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of from about 10% to 50%.

40. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 50%.

41. (original) The underfill material of claim 36 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 30%.

42. (currently amended) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C; and

a plurality of solder particles in the base material comprising an eutectic solder, the particles having a volume percentage of a total volume of the underfill material of from 10% to 50% and a melting temperature of from 150°C to 250°C.

43. (original) The underfill material of claim 42 wherein the polymer base material comprises a material selected from the group consisting of epoxy, silicone and polyimide.

44. (currently amended) ~~The underfill material of claim 42 wherein the particles comprise a~~

An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C; and

a plurality of solder particles in the base material comprising an eutectic PbSn solder, the particles having a volume percentage of a total volume of the underfill

material of from 10% to 50% and a melting temperature of from 150°C to 250°C.

45. (currently amended) ~~The underfill material of claim 42 wherein the particles comprise~~

An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C; and

a plurality of solder particles in the base material comprising a SnAgCu solder alloy, the particles having a volume percentage of a total volume of the underfill material of from 10% to 50% and a melting temperature of from 150°C to 250°C.

46. (currently amended) The underfill material of claim 42 45 wherein the particles have a diameter of from 1 μm to 10 μm .

47. (currently amended) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

a polymer base material having a no flow viscosity at a temperature of from 15.5°C to 37.8°C;

a plurality of solder particles in the base material comprising an eutectic solder, the particles having a diameter of from 1 μm to 10 μm , a melting temperature of from 150°C to 250°C. and a concentration selected such that the

underfill material is non-conductive in X and Y directions; and

a curing agent in the base material configured to cure the base material.

48. (original) The underfill material of claim 47 wherein the curing agent comprises a solvent or a reactant.

49. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is from about 10% to 50%.

50. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is less than about 50%.

51. (original) The underfill material of claim 47 wherein the concentration expressed as a volume percentage of a total volume of the underfill material is less than about 30%.

52. (currently amended) The underfill material of claim 47 wherein the ~~particles comprise~~ eutectic solder comprises a Pb free solder alloy.

53. (currently amended) An underfill material for encapsulating connections between a semiconductor component and a substrate comprising:

an electrically insulating polymer base material configured for deposition onto the substrate or the component as a non-flowing viscous material; and

a plurality of metal particles in the base material configured to melt and to rigidify the connections, the metal particles comprising a metal selected from the group consisting of Sn, Pb, Ag, Au, Ge, Cu and In.

54. (original) The underfill material of claim 53 wherein the particles have a diameter of from 1 μm to 10 μm .

55. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of from about 10% to 50%.

56. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 50%.

57. (original) The underfill material of claim 53 wherein the particles have a volume percentage of a total volume of the underfill material of less than about 30%.

58. (currently amended) An electronic system comprising:

a semiconductor component comprising a plurality of solder terminal contacts;

a substrate comprising a plurality of substrate contacts;

a plurality of connections between the terminal contacts and the substrate contacts; and

an underfill layer attaching the component to the substrate and encapsulating the connections, the underfill layer comprising a polymer base material and a plurality of conductive particles in the base material comprising an eutectic solder with at least some of which are the particles bonded to the connections and to the substrate contacts.

59. (original) The system of claim 58 wherein the substrate comprises a module substrate and the system comprises a multi chip module.

60. (original) The system of claim 58 wherein the particles comprise solder.

61. (original) The system of claim 58 wherein the particles have a diameter of from 1 μm to 10 μm .

62. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of from about 10% to 50%.

63. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of less than about 50%.

64. (original) The system of claim 58 wherein the particles have a volume percentage of a total volume of the underfill layer of less than about 30%.

65. (currently amended) An electronic system comprising:

a semiconductor component comprising a plurality of terminal contacts comprising a solder alloy;

a substrate comprising a plurality of substrate contacts;

a plurality of connections between the terminal contacts and the substrate contacts; and

an underfill layer attaching the component to the substrate and encapsulating the connections, the underfill layer comprising a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C., and a plurality of conductive particles in the base material comprising a eutectic solder configured to alloy with the solder alloy, and having a volume percentage of a total volume of the underfill layer of from 10% to 50% and a melting temperature of from 150°C to 250°C.

66. (original) The system of claim 65 wherein the polymer base material comprises a material selected from the group consisting of epoxy, silicone and polyimide.

67. (original) The system of claim 65 wherein the particles comprise the solder alloy.

68. (original) ~~The system of claim 65 wherein the particles comprise~~

An electronic system comprising:

a semiconductor component comprising a plurality of terminal contacts comprising a solder alloy;

a substrate comprising a plurality of substrate contacts;

a plurality of connections between the terminal contacts and the substrate contacts; and

an underfill layer attaching the component to the substrate and encapsulating the connections, the underfill layer comprising a polymer base material having a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C., and a plurality of conductive particles in the base material comprising a second solder alloy configured to alloy with the solder alloy, and having a volume percentage of a total volume of the underfill layer of from 10% to 50% and a melting temperature of from 150°C to 250°C.

69. (currently amended) The system of claim 65 68 wherein the particles comprise a metal selected from the group consisting of Sn, Pb, Ag, Au, Ge, Cu and In.

70. (currently amended) The system of claim 65 68 wherein the particles have a diameter of from 1 μm to 10 μm .

71. (currently amended) An electronic system comprising:

a semiconductor component;

a substrate;

an underfill layer attaching the component to the substrate comprising a polymer base material, and a plurality of solder particles in the base material comprising an eutectic solder; and

a plurality of connections between the component and the substrate encapsulated in the underfill layer, at least one of the connections comprising a solder layer comprising a plurality of the solder particles.

72. (original) The system of claim 71 wherein the connections comprise solder terminal contacts on the components.

73. (currently amended) The system of claim 71 wherein the eutectic solder comprises a Pb free solder alloy.

~~connections, the solder layer and the solder particles comprise eutectic solder.~~

74. (original) The system of claim 71 wherein the underfill layer has a viscosity of from 7,000 to 200,000 cps at a temperature of from 22°C to 100°C.

75. (original) The system of claim 71 wherein the solder particles have a volume percentage of a total volume of the underfill layer of from 10% to 50%.

76. (original) The system of claim 71 wherein the solder particles have a melting temperature of from 150°C to 250°C.

77. (original) The system of claim 71 wherein the component comprises a semiconductor package, a semiconductor wafer or a semiconductor die.

78. (original) The system of claim 71 wherein the substrate comprises a module substrate and the system comprises a multi chip module.